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**Maintenance**

**AIR FORCE METROLOGY AND CALIBRATION  
(AFMETCAL) PROGRAM**

**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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McCall)

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Bergren)

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This instruction implements AFD 21-1, *Managing Aerospace Equipment Maintenance*. It provides instruction on how to operate and manage the AFMETCAL Program. It applies to all Air Force activities responsible for designing, developing, controlling, maintaining, and life cycle management of test, measurement, and diagnostic equipment (TMDE). Maintain and dispose of records created as a result of the processes prescribed in this instruction in accordance with AFMAN 37-139, *Records Disposition Schedule*.

**SUMMARY OF REVISIONS**

Aerospace Guidance and Metrology Center (AGMC) replaced by AFMETCAL Detachment 1. Changed Air Force Measurement Standards Laboratory (AFMSL) to Air Force Primary Standards Laboratory (AFPSL). Documents new task for AFMETCAL Detachment 1 to work with the Ballistic Missile Defense Organization (BMDO). Replaced MIL-STD-45662 with ANSI/NCSL Z540-1-1994; HAF-LG (SA) 9450 changed to HAF-ILM (A) 9450 and the input media changed. HAF-LG (SA) 7808 changed to HAF-ILM (SA) 7808. Added paragraphs for user/owner responsibilities including need for TMDE users to coordinate local procurement of new TMDE with the Precision Measurement Equipment Laboratory (PMEL) and to request assurance of traceability when seeking calibration service outside the AFMETCAL Program. Added responsibilities for AFMETCAL Detachment 1 to make calibration responsibility determinations and develop, maintain, and distribute calibration procedures. Changed the term “organic” PMEL to “Type V” PMEL.

**1. Program Purpose.** The AFMETCAL Program ensures systems and equipment measurements are accurate, uniform, reliable, and traceable to the National Institute of Standards and Technology (NIST) or other sources as approved by AFMETCAL Detachment 1. It is Air Force policy that TMDE used to verify any meaningful (quantifiable) measurements will be calibrated.

**2. Program Operation.** The AFMETCAL Program is a hierarchical system of calibration laboratories, equipment, and procedures to ensure systems and equipment measurements are accurate, uniform, reliable and traceable to NIST or other sources approved by AFMETCAL Detachment 1. In this hierarchy, AFMETCAL Detachment 1 serves as the Air Force technical authority on Metrology issues and is the Air Force single point of contact for calibration services and traceability of measurements to NIST. AFMETCAL Detachment 1 then provides traceability through the Air Force Primary Standards Laboratory (AFPSL) to Precision Measurement Equipment Laboratories (PMELs). PMELs are established at selected installations and serve as the base-level AFMETCAL Program focal point. PMELs are owned and operated by their respective MAJCOM or FOAs to provide calibration and maintenance support to TMDE operated by users within a specified geographic region. At times, PMELs are required to take specialized calibration standards to a customer site to perform calibrations in place. PMELs are subdivided into different types based on their measurement capabilities and geographic area of support. USAF calibration laboratories (both the AFPSL and PMELs) utilize AFMETCAL Detachment 1 approved calibration procedures and operate environmentally controlled laboratories in accordance with AFMETCAL Program requirements contained in T.O. 00-20-14. The AFMETCAL Program adheres to the general requirements of ANSI/NCSL Z540-1-1994. Additionally, laboratories must participate in the AFMETCAL Assessment and Certification program. The Assessment and Certification Program objective is to assess each laboratory's compliance with T.O. 00-20-14 and their capability to perform measurements that are accurate, reliable, and traceable to the NIST or other sources as approved by AFMETCAL Detachment 1. An AFMETCAL Program Certificate of Compliance is awarded when a laboratory meets assessment criteria.

**3. PMEL Opening or Closing Authority.** All Air Force activities planning to open or close an Air Force PMEL shall coordinate with the AFMETCAL Materiel Group Manager (MGM) (AFMETCAL Detachment 1/CC); 813 Irving-Wick Dr W, Ste 4M; Heath OH 43056-6116 and forward a coordinated proposal to HQ USAF/ILM for approval. Installations shall not have more than one Type II or one Type III PMEL.

#### **4. Relationship With Other Agencies and Programs.**

4.1. NIST. NIST is an agency of the U.S. Department of Commerce's Technology Administration and is the US national authority for measurements, technology and standards. AFMETCAL Detachment 1 is the Air Force single point of contact for calibration services and traceability of measurements to NIST. The AFMETCAL Program obtains support services from NIST as identified in a memorandum of understanding between the DoD and the Department of Commerce.

4.2. US Naval Observatory (USNO). Air Force precise time and time interval standards are traceable to the USNO.

4.3. Security Assistance Program, Military Assistance Program, and Foreign Military Sales. The AFMETCAL Program supports authorized foreign countries and international organizations with metrology services under the Foreign Assistance Act and Arms Export Control Act.

#### **5. HQ USAF/ILM Responsibilities:**

5.1. Establishes policy for managing and operating the AFMETCAL Program.

5.2. Provides an advisor to the AFMETCAL Program Advisory Group.

5.3. Serves as the single Air Force authority to establish or close a Type II or III PMEL.

**6. HQ AFMC Responsibilities.** Designated as lead command for this program and as such, implements policy and provides the AFMETCAL Program with management and operation support.

**7. AFMETCAL Detachment 1 Responsibilities:**

7.1. Serves as the program manager for the AFMETCAL Program and the MGM for cradle-to-grave management of Air Force Measurement Standards and PMEL Base Measurement Standards.

7.2. Manages operation and maintenance of the Air Force Primary Standards Laboratory (AFPSL).

7.3. Serves as the Air Force single point of contact for obtaining metrology services from NIST and USNO.

7.4. Provides an Air Force member to the DoD's Joint Technical Coordination Group for Calibration and Measurement Technology (JTCCG-CMT) and provides support to sub-group activities according to the Joint Program Operational Plan.

7.5. Provides metrology technical and engineering services to operating commands and AFMC centers and laboratories to resolve metrology problems and to develop or improve calibration techniques.

7.6. Develops metrology support concepts and provides calibration equipment to support Automatic Test Equipment (ATE) and Systems (ATS) in coordination with the ATS Product Group Manager (PGM) and System Program Director (SPD).

7.7. Makes calibration responsibility determinations and establishes initial calibration intervals for TMDE. Adjusts calibration intervals based on analysis of maintenance data.

7.8. Serves as the approval authority for requests for commercial calibration of TMDE.

7.9. Evaluates and certifies all USAF PMELs, including contractor operated PMELs, and all entities providing calibration services for the Air Force.

7.10. Recommends appropriate action for uncertified PMELs, including PMEL closure, to the owning major command (MAJCOM) and HQ USAF/ILM.

7.11. Voids a PMEL's certification and discontinues support of selected base measurement standards if a PMEL:

7.11.1. Is unable to show traceability to NIST.

7.11.2. Lacks technical capability required to calibrate customer TMDE.

7.11.3. Fails to provide adequate facilities and controlled environment for those facilities.

7.12. Chairs a semiannual AFMETCAL Advisory Group meeting and is responsible for its charter.

7.13. Works with AFMC operated Air Force Research Laboratory and Centers and reviews Technology Area Plans to plan for future standards and support requirements.

7.14. Works with the DoD Ballistic Missile Defense Organization (BMDO) to identify metrology needs and manage development of national and DoD measurement standards and calibration services

7.15. Budgets for and manages:

7.15.1. PMEL and AFPSL calibration standards acquisition.

- 7.15.2. AFMETCAL Research & Development requirements to develop adequate national and Air Force calibration standards.
- 7.15.3. Calibration and maintenance services provided through the AFPSL.
- 7.15.4. Development and distribution of Air Force Calibration Technical Orders.
- 7.16. Is the Air Force metrology focal point for countries participating in the Security Assistance Program.
  - 7.16.1. Coordinates all metrology related security assistance activities with the Air Force Security Assistance Center (AFSAC).
  - 7.16.2. Ensures Air Force weapon systems and equipment sold to Security Assistance Program countries are supportable by the country's metrology and calibration program or another source.
- 7.17. Coordinates with MAJCOM, FOA, and DRU PMEL functional area managers (FAMs) to:
  - 7.17.1. Establish facility standards for PMELs.
  - 7.17.2. Develop and publish T.O. 00-20-14.
  - 7.17.3. Identify requirements for new and replacement calibration standards. Consider equipment that could improve PMEL effectiveness and productivity.
  - 7.17.4. Identify metrology training requirements.
  - 7.17.5. Identify applicable allowance source code entries to the ASC manager.
  - 7.17.6. Redistribute excess PMEL calibration standards.
  - 7.17.7. Support AFMETCAL Detachment 1 approved calibration software developed by PMELs for Air Force wide use.
  - 7.17.8. Identify and report metrology and calibration measurement deficiencies to SPDs at the earliest point in system development and acquisition.
  - 7.17.9. Develop and publish an AFMETCAL MGM Master Plan to budget for and acquire PMEL equipment.
  - 7.17.10. Coordinate the use of PMEL services to support Security Assistance activities.
  - 7.17.11. Provide guidance to the Standards System Group for the development and maintenance of a PMEL management information system.
  - 7.17.12. Coordinate validation and verification of calibration technical orders.
- 7.18. Works with AFMC single managers to:
  - 7.18.1. Review weapon system and equipment measurement requirements during system development and acquisition to ensure AFMETCAL program support.
  - 7.18.2. Recommend design changes to improve system and equipment supportability.
  - 7.18.3. Adjust AFMETCAL support concepts and procedures to meet weapon system and equipment mission requirements.
  - 7.18.4. Identify contract data requirements.

- 7.18.5. Evaluate contractor prepared Calibration and Measurement Requirement Summary (CMRS) and Support Equipment Recommendation Data (SERD) or equivalent data.
- 7.18.6. Provide ad hoc membership on single manager system sustainment planning or support equipment integrated product development teams.
- 7.18.7. Ensure contracts for acquisition of support equipment require compliance with ISO 10012-1, General Requirements for Calibration Labs and Measuring and Test Equipment.
- 7.18.8. Ensure weapon systems and equipment development contracts require an assessment of calibration and measurement requirements, using MIL-HDBK-1839, *Calibration and Measurement Requirements* as a guide. Based on the assessment, AFMETCAL Detachment 1 may request the development of a CMRS.
- 7.18.9. Publishes and maintains Air Force Weapon System Calibration and Measurement Summary (CMS) technical orders.
- 7.18.10. Provide metrology-related government furnished equipment (GFE) to Air Force contractors when available.

## **8. AFMC Single Manager Responsibilities:**

- 8.1. Integrate metrology and calibration requirements in weapon system and equipment planning processes.
- 8.2. Ensure contracts for acquisition of equipment require compliance with ISO 10012-1.
- 8.3. Identify all acquisition and test and evaluation activity metrology-related GFE/CFE requirements to the AFMETCAL MGM.
- 8.4. Include MIL-HDBK-1839 as a guide in contracts for new weapon systems and equipment.
- 8.5. Identify requirements for equipment not currently supportable by the AFMETCAL Program.
- 8.6. Provide for depot level maintenance to restore TMDE to serviceable condition.

## **9. MAJCOM and FOA Responsibilities:**

- 9.1. Designate a PMEL FAM to:
  - 9.1.1. Coordinate implementation of the AFMETCAL Program.
  - 9.1.2. Serve as a member of the AFMETCAL Program Advisory Group.
  - 9.1.3. Coordinate all Technical Requirements Documents (TRD) covering PMEL support with AFMETCAL Detachment 1 for review, comment and all command crosstell prior to solicitation in order to ensure sustainment of effective AFMETCAL program management.
  - 9.1.4. Provide an information copy of contracts and major amendments for contractor-operated PMELs to AFMETCAL Detachment 1.
- 9.2. Operate and maintain certified PMELs at selected bases to:
  - 9.2.1. Support all TMDE for which a PMEL is responsible.
  - 9.2.2. Support contractors working under a DoD support agreement or contract.

- 9.2.3. Support other DoD agencies as available resources allow (Reference DoDI 4000.19).
- 9.2.4. Support other federal agencies when approved by HQ USAF.
- 9.2.5. Support Security Assistance calibration programs when approved by HQ USAF.
- 9.2.6. Make use of an approved automated management system.
- 9.2.7. Accomplish TMDE scheduling and maintenance data collection according to AFCSM 21-303, Precision Measurement Equipment Laboratory (PMEL) Automated Management System (PAMS): Q011/CJ (PA) SOFTWARE USERS MANUAL. Selected activities submit maintenance data collection information on TMDE per instructions from AFMETCAL Detachment 1.
- 9.3. Implement a quality program in each PMEL, including contractor operated PMELs, and ALC Type V PMELs (see T.O. 00-20-14).
- 9.4. Require each PMEL to provide a copy of the Local-Master-ID.Data and the OWC-Master.Data files on a quarter inch cartridge (QIC) tape produced on the PAMS. This data will be as of 31 December and is due at AFMETCAL Detachment 1/MLC not later than 31 January (RCS: HAF-ILM [A] 9450, *PMEL Inventory Listing*, applies). This report is designated emergency status code C2. Continue reporting, precedence normal. Submit data requirements in this category as prescribed, or as soon as possible after submission of priority reports. Do not send by message during MINIMIZE.
- 9.5. Require each PMEL to complete an AFTO Form 80, **Precision Measurement Equipment Laboratory (PMEL) Report**, every 6 months to provide AFMETCAL Det 1/MLSP a summary of PMEL workload, personnel, and facilities. This data will be as of 30 June and 31 December and is due at AFMETCAL Det 1 not later than 31 July and 31 January (RCS: HAF-ILM [SA] 7808 *Precision Measurement Equipment Laboratory [PMEL] Report*, applies). This report is designated emergency status code C2. Continue reporting, precedence normal. Submit data requirements in this category as prescribed, or as soon as possible after submission of priority reports. Do not send by message during MINIMIZE.
- 9.6. Coordinate with AFMETCAL Det 1/MLC to schedule evaluation of each PMEL.
- 9.7. Assist non-PMEL activities to develop an effective program to support TMDE.
- 9.8. Review and verify calibration procedures in cooperation with AFMETCAL Det 1.

## **10. Test Measurement, and Diagnostic Equipment (TMDE) User/Owner Responsibilities:**

- 10.1. Establish an effective program to support TMDE designated as user/owner responsibility per the requirements in T.O. 00-20-14 and T.O. 33K-1-100-1/2.
- 10.2. Ensure TMDE is calibrated in accordance with published calibration schedules and CMSs and T.O. 33K-1-100-1/2. Failure to calibrate TMDE in accordance with published calibration schedules can constitute negligence against the Air Force.
- 10.3. When considering local procurement of TMDE, first coordinate with the supporting PMEL to determine their ability to maintain potential local purchases of TMDE in accordance with Air Force policy in AFI 21-116 and AFMAN 23-110 Vol. 2 Part 13 Chapter 8.
- 10.4. Submits requests for commercial calibration of TMDE to AFMETCAL Det 1.

## **11. Standard Systems Group Responsibilities:**

- 11.1. Responsible for PMEL Automated Management System (PAMS) software.
- 11.2. Assists the MAJCOM FAMS in redistribution of excess PAMS assets when requested.
- 11.3. Works with the AFMETCAL MGM and MAJCOM FAMS to identify PMEL requirements for a management information system.

JOHN W. HANDY, Lt. General, USAF  
DCS/Logistics

**Attachment 1****GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

AFPD 21-1, *Managing Aerospace Equipment Maintenance*

ISO 10012-1, *Quality Assurance Requirements for Measuring Equipment*

T.O. 00-20-14, *Air Force Metrology and Calibration Program*

MIL-HDBK-1839, *Calibration and Measurement Requirements*

ANSI/NCSL Z540-1-1994, *General Requirements for Calibration Labs and Measuring and Test Equipment*

AFCSM 21-303, *Precision Measurement Equipment Laboratory (PMEL) Automated Management System (PAMS): Q011/CJ (PA) SOFTWARE Users Manual*

AFMAN 23-110, *Standard Base Supply Customers's Procedures*

AFI 21-116, *Maintenance Management of Communications-Electronics*

***Abbreviations and Acronyms***

**AF**—Air Force

**AFMC**—Air Force Materiel Command

**AFMETCAL Detachment 1**—Detachment 1, WR-ALC, Heath, OH. AFMETCAL Det 1/CC is MGM for the Air Force Metrology and Calibration Program

**AFMETCAL Program**—Air Force Metrology and Calibration Program

**AFPSL**—Air Force Primary Standards Laboratory

**AFSAC**—Air Force Security Assistance Center

**AFTO**—Air Force Technical Order (as used on forms)

**ALC**—Air Logistic Center

**ATE**—Automatic Test Equipment

**ATS**—Automatic Test Stations

**BMDO**—Ballistic Missile Defense Organization

**CMRS**—Calibration and Measurement Requirements Summary

**CMS**—Calibration and Measurement Summary

**DoD**—Department of Defense

**FAM**—Functional Area Manager

**FMS**—Foreign Military Sales

**FOA**—Field Operating Agency



**GFE**—Government Furnished Equipment

**JTCG-CMT**—Joint Technical Coordinating Group (for) Calibration and Measurement Technology

**MAJCOM**—Major Command

**MGM**—Materiel Group Manager

**NIST**—National Institute of Standards and Technology

**PAMS**—Precision Measurement Equipment Laboratory (PMEL) Automated Management System

**PGM**—Product Group Manager

**PMEL**—Precision Measurement Equipment Laboratory

**PWC**—Performing Work Center

**SERD**—Support Equipment Recommendation Data

**SOW**—Statement Of Work

**SPD**—System Program Director

**TMDE**—Test, Measurement, and Diagnostic Equipment

**TRD**—Technical Requirements Document

**USNO**—United States Naval Observatory

### *Terms*

**Air Force Metrology and Calibration (AFMETCAL) Program**—Comprises measurement standards and TMDE, professional and technical metrologists, performing work centers (PWCs), a system of worldwide laboratory facilities (PMELs), TMDE users, calibration data, and integrated planning. The program provides for maintenance and calibration of TMDE to verify the reliability and ensure the accuracy of systems, subsystems, and equipment.

**AFMETCAL Program Advisory Group**—A group chartered to monitor maintenance and calibration support provided by USAF PMELs to Air Force Systems. It meets periodically to review AFMETCAL program issues and permit MAJCOM coordination concerning PMEL support.

**Air Force Primary Standards Laboratory (AFPSL)**—The highest level standards laboratory in the AFMETCAL Program. It maintains Air Force measurement standards certified by the NIST, the US Naval Observatory (USNO), or other nationally recognized standards. The AFPSL (located at Heath, Ohio) uses these measurement standards to calibrate base level or PMEL measurement standards and equipment for Air Force customers.

**Calibration**—A comparison between items of equipment, one of which is a measurement standard of known accuracy, to detect, correlate, adjust, and report any variation in the accuracy of the other item.

**Calibration and Measurement Requirement Summary (CMRS)**—This is a three category, in-line, summary of measurement parameters. Normally a Department of Defense (DoD) system contractor prepares the CMRS. A CMRS identifies all measurement requirements within a specific system or item of equipment. The CMRS further displays the contractor's proposed solutions for maintaining the system measurement requirements within the stated limits. This data is provided to AFMETCAL Detachment 1/MLS, 813 Irving Wick Dr W, Ste 4M, Heath OH 43056-6116. AFMETCAL Detachment 1/ML uses it for

ensuring calibration supportability and planning for PMELs support for a particular weapon system/subsystem. AFMETCAL Detachment 1/MLS is the approving authority for CMRS data.

**Calibration and Measurement Summary (CMS)**—A technical order which identifies calibration support necessary to ensure the operational readiness of a specific weapon system. The summary describes the calibration concept and identifies the organization responsible for support. It is also used for identification of needs for new calibration standards and equipment locations. At the same time the need for new 33K series T.O. calibration procedures is reviewed. The CMS is printed as a weapon system or equipment series T.O. AFMETCAL Detachment 1/MLS publishes and maintains CMSs for several Air Force systems.

**Certification**—The documented designation that standards and TMDE have been calibrated and meet established technical requirements. It can also mean that a calibration laboratory (PMEL or AFPSL) has successfully fulfilled the AFMETCAL assessment criteria of T.O. 00-20-14.

**Materiel Group Manager (MGM)**—The generic title for an individual in an AFMC Materiel Group who is ultimately responsible and accountable for decisions and resources in overall materiel group management. The MGM is the single person who is charged with all cost, schedule and performance aspects of a materiel group. The MGM's primary customers for the daily sustainment products and services and new equipment acquisitions are the using MAJCOMs. However, the MGM's customers for integration of new development and technology transition are the respective program group managers and system program directors.

**Metrology**—The science or system of weights and measures used to determine conformance to technical requirements, including the development of standards and systems for absolute and relative measurements.

**Precision Measurement Equipment Laboratory (PMEL)**—A laboratory facility authorized to have Air Force base measurement standards and responsible for calibration, maintenance, and certification of TMDE. Authorizations for PMEL equipment and facility requirements are tailored to meet specific requirements for supported missions. PMELs are the base level link for measurement transfer and maintenance for all systems in the Air Force.

**Product Group Manager (PGM)**—The individual managing an AFMC Product Group who is ultimately responsible and accountable for decisions and resources in overall product group management. The PGM is the single person who is charged with all cost, schedule and performance aspects of a product group and related sustainment activities. Typically, the PGM's product is in direct support of one or more military system program directors.

**Technical Requirements Document (TRD)**—A document that accurately describes essential and technical requirements for items, materials, or services, including the standards used to determine whether the requirements have been met. This document is sometimes called a Statement Of Work (SOW).

**Support Equipment Recommendation Data (SERD)**—A contractual data item submitted by the contractor to identify weapon system support equipment requirements.

**Single Manager (SM)**—The generic term to describe System Program Directors, Product Group Managers, and Materiel Group Managers.

**System Program Director (SPD)**—That individual in an AFMC System Program Office who is ultimately responsible and accountable for decisions and resources in overall program execution of a military system. The single face to the user who oversees the seamless processes.

**Test, Measurement, and Diagnostic Equipment (TMDE)**—Those devices used to maintain, evaluate, measure, calibrate, test, inspect, diagnose, or otherwise examine materials, supplies, equipment, and systems to identify or isolate actual or potential malfunctions, or decide if they meet operational specifications established in technical documents.

**Types of Standards Used in Measurement and Testing**—The term "standard" means equipment or physical constants serving as the basic means by which we derive accurate and traceable precision measurements. These standards include:

**National Measurement Standards**—Equipment or physical constants identified by NIST to serve as a basic measurement reference throughout the United States.

**Air Force Measurement Standards**—Equipment certified by NIST or AFMETCAL Detachment 1 approved sources, and used by the AFPSL as a basic measurement reference for the US Air Force.

**Air Force Base Measurement Standards**—Equipment certified by the AFPSL or AFMETCAL Detachment 1 approved sources for use by an Air Force PMEL as a measurement reference.

**Working Standards**—PMEL certified TMDE used to calibrate other TMDE.